WASHINGTON
SCIENCE TRENDS

HIGHLIGHTS

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ICBM Defense

Advanced Research Projects Agency is moving into a period of heavy spending on new equipment and techniques for the detection and possible interception of incoming ballistic missiles. Some of these devices will be tested in the Pacific in 1960 and 1961.

Pacific Installation: ARPA will establish a testing site on Roi Namur Island, about 45 miles from the Army's Nike Zeus anti-missile installation on Kwajalein Atoll. Targets for both sites will be unarmed IRBM-type missiles such as the Jupiter launched from Johnston Island 1,420 miles away. There have also been discussions of test-launching Polaris IRBM's from submarines in the same area, when available.

Radars:Tracking duties will be primarily to determine at how early a time in their trajectory a positive identification can be made of ballistic missile warheads.

ARPA is procuring through the Army, under a $3,940,00 contract, an RCA modified radar of a type originally designed for the Ballistic Missile Early Warning System. In another contract, totalling approximately $15 million, the Raytheon Company will supply a so-called "Pincushion" radar for precision microwave measurements outside the earth's atmosphere. Delivery of this unit is expected in late 1961. This advanced-type radar will use Amplitron power tubes said to make possible extremely high power levels in a relatively small space.

Test Program: Installation will play a key role in ARPA's Project Defender, a research, experimentation and systems feasibility demonstration to obtain technologically advanced defense against what the Agency describes as "extra-atmospheric offensive vehicles." The Pacific tests, and other phases of the project, are aimed toward exploration of fundamental phenomena, development of new concepts and application of new techniques.

The radars will be used for investigation of ballistic missile characteristics throughout the trajectory from the limit of radar range to reentry into the lower atmosphere. The units will operate on several different frequencies in order to exploit various flight phenomena.

Cost: ARPA estimates total cost of the facility at from $75 to $100 million. This would include the radars, support facilities, one year's operations and a rapid data processing system which "may" added to the island complex at a later date.

Project Echo

National Aeronautics and Space Administration (NASA) hopes to launch the first of three 100-foot diameter inflatable spheres from Cape Canaveral next March in Project Echo, the first step toward a possible global communication relay system. Independent researchers are invited to make use of the sphere for radio propagation experiments.

Here is a summary from official reports of the technical details of the experiment:

*Sphere: Inflatable structure, will be made of mylar .0005 inch thick, coated with vapor-deposited aluminum to provide radio wave reflectivity of 98 percent or better, up to frequencies of 4800 megacycles.

Sphere will be fabricated of 82 flat gores of material, butted against each other, with an overlapping strip which forms a capacitor (of about 120 mmf per linear foot of seam at 1 kc). A "pole cap" at the top and bottom of the satellite is used to connect all gores electrically.

Prior to launching sphere will be folded into a 28-inch diameter container. A small amount of residual air is expected to provide initial partial inflation. Approximately four pounds of water, to be sprayed from two elastic bags within the structure, is expected to provide enough internal pressure to retain a spherical shape under expected micrometeorite damage for at least a week. As insurance, a sublimating powder will be carried to provide additional gas to sustain internal pressure.

*Launch and Orbit: First sphere will be launched Northeast from Cape Canaveral at an inclination of approximately 50° from the Equator. Altitude will be about 900 miles. Launching vehicle will be a so-called Delta rocket, consisting of a Thor first stage, an Able (Vanguard) second stage and an Allegany Ballistics Laboratory 248 solid propellant rocket third stage. First passes over the U.S. are expected to be at twilight and it is estimated that the satellite will be easily visible, having a brightness of zero magnitude at the zenith -- greater than that of the star Vega.

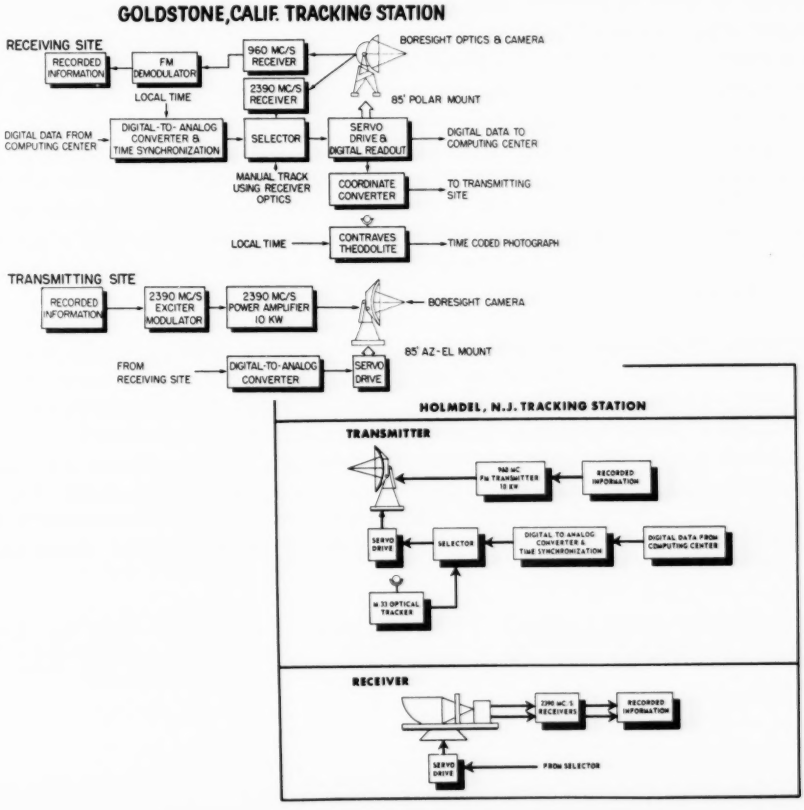
*Initial Tracking: Third stage of the launching vehicle will carry a beacon transmitting on 108.00 megacycles. Two beacons, now under development, may be attached directly to the sphere for operation at 107.94 and 107.97 megacycles.

*Coast-to-Coast Communications Experiment: Once in orbit, attempts will be made to use the sphere for passive two-way communications between the East and West coasts. A West Coast station will be operated by the Jet Propulsion Laboratory at Goldstone, Calif. A transmitting and receiving site will be located at Holmdel, N.J. and a receiving-only site will be located at the Naval Research Laboratory facility, Stump Neck, Md. For East-to-West transmission 960 megacycles will be used, with 2390 megacycles employed for West-to-East transmission.

* Experiments: Initial experiments will be performed using continuous wave transmission to check orbital conditions. Following this, a voice modulated transmission will take place for demonstration purposes, using wideband frequency modulation techniques. Experimenters will then return to C.W. to perform propagation experiments which will involve investigations in the scintillations which may occur in the satellite reflections, Faraday rotation, fading and polarization measurements. Receiving system at Holmdel will incorporate dual masers to facilitate polarization study.

* Antennas: Two 85-foot paraboloid antennas will be employed at the West Coast site. The New Jersey installation will employ a 60-foot Azimuth-Elevation mounted paraboloid antenna for transmitting and a special horn-reflector antenna for receiving. NASA reports that this antenna has a very low pickup from side and back lobes and, used in conjunction with a maser, has made it possible to measure very low sky-noise temperatures. The NRL installation will employ a 60-foot paraboloid.

* Transmission: During the course of tracking the satellite the JPL installation will provide continual illumination with energy at 2390 megacycles. This energy is scattered isotropically by the reflecting sphere. The receiving antenna, a Bell Telephone Laboratory installation, will be pointed at the sphere by either an optical tracker or digital position data and thus intercept a portion of the scattered energy, establishing a West-to-East link. The same process, in reverse and at 960 megacycles, is used to complete the circuit. Transmitted power at both frequencies will be on the average of 10 kilowatts. It is expected that the satellite will be mutually visible between the East and West Coast for up to 16 minutes, depending upon local horizon conditions and the ability of receiving antennas to approach that horizon.



Research Checklist

( ) Spectral Radiant Intensity: Spectral data recently compiled by the National Bureau of Standards reportedly simplify the conversion of standards of luminous intensity into standards of spectral radiant intensity. The method is said to be useful for such purposes as the calibration of the spectral response of photosensitive receivers, or the determination of the spectral emittance of television screens.

(Details available. Single copies free. Write National Bureau of Standards, Office of Technical Information for Summary Technical Report - Standards of Spectral Radiant Intensity)

( ) Solid Propellant Oxidizer: Jet Propulsion Laboratory, Pasadena, Calif., has devised a rapid and accurate spectrophotometric method for use in quality control of ammonium perchlorate, a solid propellant oxidizer. The technique, which is said to permit determination of small amounts of chlorate impurities, is being recommended for adoption by the major consumers and vendors of rocket-grade material.

(Detailed Report available. Single copies free. Write NASA, CODE BID, 1520 H Street, N.W., Washington 25, D.C., for Publication N 76224)

( ) Cotton Glow-Discharge Treatment: Studies sponsored by the U.S. Department of Agriculture indicate that the so-called glow-discharge treatment makes cotton seed and fiber more water-absorbent, and increases the strength of cotton yarn. The treatment is also said to hold promise for the killing of weed seeds mixed with crop seeds and for higher and more uniform germination of many crop seeds. Material to be treated is placed in a glass chamber. Air is evacuated to a pressure of less than one percent of the normal atmosphere. At this point, approximately 1,000 volts is applied to electrodes at ends of the tube, and a current of 10 to 50 milliamperes is allowed to pass through the circuit.

( ) Heterogeneous Fuselage Structures: A study for the U.S. Air Force indicates that new "heterogeneous" type fuselage structures may provide significant structural weight savings in missiles and aircraft, particularly where aerodynamic heating is an important factor. The method is said to provide more options for the designer in providing paths for resisting internal forces. A full-size fuselage section is said to have shown a 45 percent weight savings over a current missile fuselage of conventional construction.

(Detailed Report available. 136 pages. $2.75. Write OTS, U.S. Department of Commerce, Washington 25, D.C., for PH 151 881)

( ) Neutron-Absorbing Bricks: The Naval Research Laboratory has developed a method for making neutron absorbing bricks from commercially available calcium boride powder as a substitute for expensive or bulky shielding materials otherwise available. A thick dry mud is made with the powder and water, followed by compression in a mold at pressures of about 2000 pounds per square inch or more. Bricks are then baked for two hours at 750°C and are said to be reasonably sized and of a fairly high density for construction of a neutron shield or sink.

( ) High Altitude Test Chamber: An improved high-altitude test chamber has been installed at the U.S. Army Signal Research and Development Laboratory, Ft. Monmouth, N.J. Unit is a stainless steel cylinder eight feet long and five and a half feet in diameter. Equipment and components can be tested in simulated 100 mile altitude environment at temperatures from -90 to +300 degrees Fahrenheit.

( ) Science Information Research: National Science Foundation has awarded grants totaling $127,700 to the Chemical Abstracts Service for research involving mechanical aids to chemical documentation. One aspect of the project deals with ways to mechanize chemical data in order to correlate structures of chemical compounds with their properties and uses -- as for example compounds containing a particular element that also have boiling points within specified ranges. Research into the semantic content of chemical literature, including means of machine programming, will also be studied.

A grant for $159,200 to the Center for Documentation and Communication Research, Western Reserve University, is designed to help support a large scale program to evaluate procedures developed for the automatic processing and searching of literature of interest to metallurgists.

( ) Capacitor Research: Studies at the National Bureau of Standards indicate the potential superiority of adjustable capacitors having electrodes in the form of coaxial cones for certain important applications. New expressions for the capacity of the conical structure have been developed, and it is suggested that multiple cone and specially shaped electrodes be used for applications involving large values of capacitance and space limitations.

(Reprint available. Single copies free. Write National Bureau of Standards, Office of Technical Information, Washington, 25, D.C. for Reprint Paper 63C2-10)

Publication Checklist

( ) Mail Automation: Outlines Post Office Department plans to spend $2 billion for modernization of its facilities, including new devices in the automation field. Opportunities for research are also explained. Single copies free. (Write General Equipment and Components Division, BDSA, U.S. Department of Commerce, Washington 25, D.C. for "U.S. Industry and the Post Office Modernization Program.")

( ) Scientific Manpower, a compilation of papers on trends in education and employment for scientists and engineers by a number of experts. 87 pages. Single copies free. (Write Information Office, National Science Foundation, Washington 25, D.C. for Publication NSF 59-37 - Scientific Manpower)

( ) Plastics - Polymer Research, a five-year bibliography of selected reports and translations in the fields of plastics and polymers, emphasizing research documents available from U.S. Government Sources. 10 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Pub. SB-400)

( ) Principles of Guided Missiles and Nuclear Weapons, a 1959 text originally published for the Navy describing in unclassified terms the general principles of guided missiles including such factors as missile flight, guided missile components, missile propulsion and control systems, various guidance systems and missile ships and systems. The second part of the text describes fundamentals of nuclear physics and the principles and effects of nuclear weapons. 284 pages. $2.00. (Available through Service Department, Washington Science Trends, National Press Building, Washington 4, D.C.)

( ) Cerium, a report on the tri-n-butyle phosphate extraction of cerium from a sulfate leach liquor prepared from a bastnasite concentrate and from pure ceric nitrate solutions. 27 pages. Single copies free. (Write Publication-Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa., for Report of Investigation No. 5513)

( ) Pure Compounds: A limited number of copies are available of a new report on a conference on chemical compounds of certified high purity held earlier this year by the National Academy of Sciences. Single copies free. (Write Office of Critical Tables, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D.C. for Conference Report - Pure Compounds)

( ) Fission Products Decay Energy, a literature search listing 75 unclassified reports concerning energy release in various forms from irradiated materials. 9 pages. 50 cents. (Write OTS, Department of Commerce, Washington 25, D.C. for Publication TID - 3536)